NOTE ON THE COLOR OF THE MOON.

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On the 19th of September, 1873, I presented to the Society certain views which as it seemed to me offered a satisfactory explanation of the change of color undergone by the moon during the passage of the twilight circle over her disc. I stated at that time that since what light we get from the moon is reflected solar light, which so far as we can discover has suffered no change on the surface of the moon, it would be natural to suppose that the color of the light would be the same as that of the Sun's light.

The Sun's light is well known to be orange, and the Moon's in the day time white, while at night the latter exhibits the same color as the Sun, though the light is vastly more feeble.

That this change of color in the Moon depends upon the position of the observer relative to the Sun there can be no doubt, and it is equally certain that the phenomenon is of atmospheric origin, for the moon still remains white for some time after the Sun has set.

If, as Tyndall supposes, the blue color of the sky be due to the scattering of the smaller waves of light by the infinitessimal particles or motes of the upper atmosphere; and if the paths pursued by these reflected blue waves be, as experiment proves, in all directions from all parts of this attenuated matter, the change of color may be easily explained.*

Thus the Sun appears to us orange or yellow, because, of the waves constituting white light, which impinge upon our atmosphere, a greater proportion of blue than of red and yellow waves are scattered. Of these waves thus scattered, a large proportion is thrown out again into space, while what remain are sent in all directions—even directly towards the Sun.

This is *one cause* of the blueness of the sky, if not the only one.

When the Moon is shining at night the same conditions are fulfilled. A small fraction of the Sun's light is thrown unchanged into our atmosphere and suffers the same filtering which his beams in daylight undergo; with this difference, that as the blue rays are very inferior to the yellow in luminousness, the more the *amount* of light is diminished, the brighter relatively to the whole amount will appear these scattered rays; and

*The objection that if the waves of light were thus sifted by tenuous matter, those of least length (or the ultra violet) would impart their color to the sky is invalid because Tyndall has shown, and every one can demonstrate for himself, that the earliest appearance of color in a medium in which infinitessimally fine particles of matter are suspended *is* blue. Vide "Blue color of sky," &c., Tyndall.

thus it happens that in a clear moon-light night the sky is much more strikingly blue than the same sky would be at mid-day.

When the Moon shines in the day-time we must suppose that the rays she sends to us are affected in precisely the same way as at night. If she appear white (as is the case) it must be owing to an addition to this light of the constituents which it has lost, viz., blue. We know that these waves are coming to the eye from every part of the sky, and therefore from that part occupied by the disc of the Moon, and hence the inference is natural that this contribution from the store of the Sun's light just makes up what was necessary to produce white light, and that as this accession can go on after the setting of the Sun, and until the twilight circle has passed over the Moon, the whiteness of the latter will commence to fade as the thickness of shell of direct rays diminishes, and the maximum of deviation from the color (under given conditions of the atmosphere) will be reached just after the Sun has reached a point in the heavens whence the last direct ray tangent to the earth's surface falls in the upper limits of the atmosphere on a line joining the Moon with the eye of the observer.

But there is a practical mode of testing this hypothesis, which is dependent upon the polarization of the sky light in directions perpendicular to the Sun's rays.

When the Moon is in her first quarter she lies in just this direction from the observer; and since the blue light from the Sun, which, added to her own, causes her to appear white, is polarized, the Moon when viewed through a Nicols' prism by day ought to appear orange.

This observation has been many times repeated by me, and the results are precisely those anticipated.

Owing to the fact that there is always some unpolarized light received in this direction the change of color is not quite so marked as is that from day to night, still the change is very striking and unmistakable.

There is another cause for the blue color of the sky which is the effect of contrast in the eye. If all the light which was reflected was white light and very generally diffused over the firmament, the effect of the bright yellow orb of the Sun or Moon would be to tinge this light with blue so far as the subjective phenomenon was concerned. But that this does not explain the whole of the phenomenon is evident from the fact that the blue light obtained by Tyndall from his decomposition tubes was also polarized in a direction perpendicular to the path of the beam.